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5 United States of America, a resident of Bridge City, County of Orange, State  
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7 resident of The Woodlands, County of Montgomery, State of Texas, have  
8 invented new and useful improvements in a

9

**POLYMERIC BASED CARPET**

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## **POLYMERIC BASED CARPET**

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### FIELD OF THE INVENTION

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The present invention relates to a polymeric based carpet.

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### BACKGROUND OF THE INVENTION

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It is desired in the textile industry to create products that are 100 percent recyclable with minimum difficulty. Today's commercially provided carpet products are predominantly manufactured using a latex based binder to adhere the backing scrim to the carpet fibers. The purpose of the scrim and latex are to bind the carpet fibers and prevent the fibers from becoming unwoven or loose. The latex is undesirable from a recycling point of view. In order to reclaim the carpet fibers and scrim, which are normally polypropylene, polyester, or polyamide based, the latex has to be separated from the total composite.

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A method of making and recycling carpet of all recyclable material has been disclosed. The disclosed carpet includes a primary backing having tufts of synthetic carpet fibers protruding from a top surface and, optionally, a secondary backing, with an extruded sheet of an isotactic polyolefin polymer between and integrally fused to a bottom surface of the primary backing and an upper surface of the secondary backing. The isotactic polyolefin polymers shown to be effective to fuse the carpet fibers and the secondary backing in the disclosure are isotactic polypropylene and extruded blends of polypropylene with polyethylene, polybutylene and thermoplastic elastomers. The previous disclosures teach that polyethylene copolymers alone are a poor choice for such a fusion material. Furthermore, it has been disclosed that if anything other than polypropylene is used for the face fiber, extruded

1 sheet and secondary back, that the bonding of the materials must be  
2 physically separated before recycling can take place.

3 In contrast, in the present invention, the use of ethylene methyl acrylate  
4 copolymers as such a fusion material replacement for latex conventionally  
5 used to bind carpet fibers to backing material not only eliminates the need for  
6 a separation recovery process but also enhances the total products'  
7 performance when recycled. Furthermore, such a copolymer has advantages  
8 over polypropylene and the various polypropylene blends previously  
9 disclosed.

#### 10 SUMMARY OF THE INVENTION

11 The present invention relates to a carpet composition, recyclable without a  
12 separation step, having from 50 to 100 percent polymeric material comprising:

- 13 a) a tufted primary backing having a primary backing and tufts of  
14 carpet fibers penetrating a bottom surface of the primary  
15 backing and protruding from a top surface of the primary  
16 backing;
- 17 b) a secondary backing material; and
- 18 c) an extruded adhesive material or a coextrusion of two or more  
19 extruded adhesive materials binding an upper surface of the  
20 secondary backing material to the bottom surface of the primary  
21 backing;

22 in which the carpet fibers, primary backing material and secondary  
23 backing material are selected from the group consisting of

1 polypropylene, polyester, acrylics, polyethylene, polyamide, nylon,  
2 wool, cotton, rayon and combinations thereof;

3 and in which the adhesive material comprises an amorphous  
4 polyethylene copolymer selected from the group consisting of ethylene  
5 methyl acrylate, ethylene normal butyl acrylate, and blends of two or  
6 more polyethylene copolymers.

7 In a preferred embodiment, the extruded adhesive material of the above  
8 described carpet composition comprises a middle layer of polyethylene  
9 sandwiched between two outer layers selected from the group consisting of  
10 ethylene methyl acrylate and ethylene normal butyl acrylate.

11 In a more preferred embodiment, the middle polyethylene layer of the above  
12 described extruded adhesive material is from 10 to 90 weight percent of the  
13 extruded adhesive material and each of the two outer layers is from 5 to  
14 45 weight percent of the extruded adhesive material.

15 In another preferred embodiment, the adhesive material of the above  
16 described carpet composition further comprises maleic anhydride.

17 In yet another preferred embodiment, the adhesive material of the above  
18 described carpet composition is a coextruded blend of ethylene methyl  
19 acrylate copolymers and polymers selected from the group consisting of low  
20 density polyethylenes, linear low density polyethylenes, high density  
21 polyethylenes, ultra low density polyethylene having a density less than 0.915  
22 density, ethylene-propylene copolymers, elastomers, rubber, EPDM (ethylene  
23 propylene diene monomer) rubber, styrenic copolymers of butadiene, styrenic  
24 copolymers of acrylonitrile, styrenic copolymers of ethylene, metallocene  
25 based polyethylenes, polypropylene, polyester, ethylene acrylic acid  
26 copolymers, ethylene methyl acrylic acid copolymers, butyl acrylate

1 copolymers, ethylene vinyl acetate copolymers, ionomers, polyamides, and  
2 maleic anhydrides.

3 In still another preferred embodiment, the adhesive material of the above  
4 described carpet composition has a thickness of from 0.001 inches to  
5 0.050 inches.

6 In yet another preferred embodiment, the adhesive material of the above  
7 described carpet composition further comprises additives selected from the  
8 group consisting of flame retardants, odor reduction additives, scent  
9 enhancing additives and ultra-violet light protection additives.

10 In still another preferred embodiment, the adhesive material of the above  
11 described carpet composition further comprises fillers selected from the group  
12 consisting of talc, calcium carbonate and other inorganic fillers.

13 The present invention also relates to a method of making a carpet, the carpet  
14 comprising a tufted primary backing with a primary backing and tufts of carpet  
15 fibers penetrating a bottom surface of the primary backing and protruding  
16 from a top surface of the primary backing; a secondary backing material; and  
17 an adhesive material binding an upper surface of the secondary backing  
18 material to the bottom surface of the tufted primary backing; the carpet fibers,  
19 primary backing material and secondary backing material being selected from  
20 the group consisting of polypropylene, polyester, acrylics, polyethylene,  
21 polyamide, nylon, wool, cotton, rayon and combinations thereof and the  
22 adhesive material comprising an amorphous polyethylene copolymer selected  
23 from the group consisting of ethylene methyl acrylate and ethylene normal  
24 butyl acrylate; the method comprising the steps of:

25 a) extruding a heated sheet of the adhesive material; and

1           b) continuously fusing together in a two roll nip the upper surface of  
2           the secondary backing and the bottom surface of the tufted primary  
3           backing with the heated sheet.

4   In a preferred embodiment of the above described method, the two roll nip  
5   comprises a hard roll and a soft roll.

6   In a more preferred embodiment of the above described method, the soft roll  
7   has a diameter of from 4 to 20 inches and a hardness of from 5 to  
8   100 shore D.

9   In another more preferred embodiment of the above described method, the  
10   soft roll is comprised of rubber.

11   In still another more preferred method, the hard roll is a cooled metal chill roll  
12   capable of maintaining a temperature below 120°F.

13   In yet another more preferred method, the two roll nip has pressure between  
14   20 and 200 pounds per linear inch.

15   The present invention also relates to a method of using at least one of  
16   ethylene methyl acrylate copolymer and ethylene normal butyl acrylate  
17   copolymer to manufacture a carpet, the carpet comprising a tufted primary  
18   backing with a primary backing and tufts of carpet fibers penetrating a bottom  
19   surface of the primary backing and protruding from a top surface of the  
20   primary backing; a secondary backing material; and an adhesive material  
21   binding an upper surface of the secondary backing material to the bottom  
22   surface of the tufted primary backing; the carpet fibers, primary backing  
23   material and secondary backing material being selected from the group  
24   consisting of polypropylene, polyester, acrylics, polyethylene, polyamide,  
25   nylon, wool, cotton, rayon and combinations thereof and the adhesive

1 material comprising an amorphous polyethylene copolymer selected from the  
2 group consisting of ethylene methyl acrylate and ethylene normal butyl  
3 acrylate; the method comprising the steps of:

4 a) extruding a heated sheet of the adhesive material; and

5 b) continuously fusing together in a two roll nip the upper surface of  
6 the secondary backing and the bottom surface of the tufted primary  
7 backing with the heated sheet.

8 In a preferred embodiment of the above described method, the two roll nip  
9 comprises a hard roll and a soft roll.

10 In a more preferred embodiment of the above described method, the soft roll  
11 has a diameter of from 4 to 20 inches and a hardness of from 5 to  
12 100 shore D.

13 In another more preferred embodiment of the above described method, the  
14 soft roll is comprised of rubber.

15 In still another more preferred embodiment of the above described method,  
16 the hard roll is a cooled metal chill roll capable of maintaining a temperature  
17 below 120°F.

18 In yet another more preferred embodiment of the above described method,  
19 the two roll nip has pressure between 20 and 200 pounds per linear inch.

20 The present invention also relates to a method of recycling a carpet, the  
21 carpet comprising a tufted primary backing with a primary backing and tufts of  
22 carpet fibers penetrating a bottom surface of the primary backing and  
23 protruding from a top surface of the primary backing; a secondary backing



1 material; and an extruded adhesive material or a coextruded blend of two or  
2 more extruded adhesive materials binding an upper surface of the secondary  
3 backing material to the bottom surface of the primary backing; the carpet  
4 fibers, primary backing material and secondary backing material being  
5 selected from the group consisting of polypropylene, polyester, acrylics,  
6 polyethylene, polyamide, nylon, wool, cotton, rayon and combinations thereof  
7 and the adhesive material comprising an amorphous polyethylene copolymer  
8 selected from the group consisting of ethylene methyl acrylate and ethylene  
9 normal butyl acrylate; the method comprising the step of melting the carpet to  
10 obtain an extrudate feedstock.

11 DETAILED DESCRIPTION OF THE INVENTION

12 A novel composite and process has been invented which creates a 50 to  
13 100 percent polymeric product which allows it to be recycled. The composite  
14 can provide water-resistant properties heretofore impossible with latex bound  
15 carpet products. In addition, the new product can incorporate performance-  
16 enhancing additives such as flame-retardants, odor reduction additives,  
17 scent-enhancing additives, ultra-violet light protection additives and inorganic  
18 materials, such as talc and calcium carbonate, for cost reduction and strength  
19 properties. It has also been found that when calcium carbonate is added as a  
20 filler, it functions as a "heat sink", i.e., it lets the polymer blend stay hot longer  
21 during the manufacturing process. This has the effect of improving the  
22 penetration of the polymer into the carpet fibers.

23 With the use of ethylene methyl acrylate based copolymers, the carpet can  
24 now be ground and reprocessed with no interim step to remove incompatible  
25 materials. When incorporated with polypropylene, polyester and polyamide  
26 polymers, methyl acrylate copolymers act as a compatibilizer to cause the  
27 new blend to adhere to itself in any subsequent fabrication process.



1 The use of ethylene methyl acrylate copolymers as a replacement for latex  
2 conventionally used to bind carpet fibers to backing material not only  
3 eliminates the need for a separation recovery process but also enhances the  
4 total products' performance when recycled. The ethylene methyl acrylate  
5 material serves as a binder for the reclaimed product as well as improving the  
6 impact resistance and pliability of the secondary produced product.

7 In addition to the novel materials used in the new composite, certain  
8 processing techniques are employed that guarantee the proper level of  
9 adhesion is obtained in the laminate. These techniques a rubber nip roll with  
10 a diameter of 4 to 20 inches, and a hardness of 50 to 100 shore D. A  
11 water-cooled metal chill roll capable of maintaining a temperature below  
12 120°F. The pressure of the rubber to steel nip is between 40 and 200 pounds  
13 per linear inch. Extrudate temperatures greater than 550°F is preferred.

#### 14 EXAMPLES

15 The invention will be further illustrated by the following examples, which set  
16 forth particularly advantageous method embodiments. While the Examples  
17 are provided to illustrate the present invention, they are not intended to limit it.

#### 18 Example 1

19 Various samples of carpet were manufactured having tufts of polypropylene  
20 interwoven in a primary backing of polypropylene with an extruded sheet of  
21 ethylene methyl acrylate copolymer sandwiched to the bottom of the primary  
22 backing and the top of a secondary backing of polypropylene. The carpets  
23 were made in two different weave styles and at various extrudate speeds and  
24 temperatures. The Fiber Lock and Tuft Bind tests were applied to the  
25 samples and were scored with Pass (P), Marginal (M) or Fail (F) scores. The  
26 results are shown in Table 1.

1

Table 1

Style	Temperature	Speed	Fiber Lock Score
Seacroft	575	100	Marginal
Seacroft	575	75	Pass
Seacroft	575	50	Pass
Seacroft	600	75	Pass
Glasgow	575	100	Pass
Glasgow	575	75	Pass
Glasgow	575	50	Pass
Glasgow	600	75	Pass

2

3

Example 2

4 Various samples of carpet were manufactured having tufts of polypropylene  
5 interwoven in a primary backing of polyamide with an extruded sheet of  
6 ethylene methyl acrylate copolymer sandwiched to the bottom of the primary  
7 backing and the top of a secondary backing of polyamide. The carpets were  
8 made in different weave styles and at various extrudate thicknesses and  
9 temperatures. The Fiber Lock and Tuft Bind tests were applied to the  
10 samples and were scored with Pass (P), Marginal (M), or Fail (F) scores. The  
11 results are shown in Table 2.

1

Table 2

Style	Extrudate Temp.	Extrudate Thickness	Fiber Lock Score	Tuft Bind Score (lb.)
Sample 1	575	5.0 mils	Fail	6.0
Sample 1	575	7.5 mils	Fail	8.0
Sample 1	575	10 mils	Pass	8.5
Sample 1	600	7.5 mils	Marginal	8.0
Heavier wt. Level loop – Polyamide				
Sample 2	575	5.0 mils	Marginal	9.0
Sample 2	575	7.5 mils	Pass	8.5
Sample 2	575	10 mils	Pass	8.0
Sample 2	600	7.5 mils	Marginal	10.5
Sample 3	575	5.0 mils	Pass	8.0
Sample 3	575	7.5 mils	Pass	12.0
Sample 3	575	10 mils	Pass (much better)	10.0
Sample 3	600	7.5 mils	Pass	N/A
Textured Level loop – Polyamide				
Sample 4	575	5.0 mils	Marginal	10.0
Sample 4	575	7.5 mils	Pass	12.0
Sample 4	575	10 mils	Pass	10.0
Sample 4	600	7.5 mils	Pass	10.0
Polyamide				
Sample 5	575	5.0 mils	Fail	10.0
Sample 5	575	7.5 mils	Fail	10.0
Sample 5	575	10 mils	Marginal	8.0
Sample 5	600	7.5 mils	Marginal	8.0
26 oz. P.A. Level loop – Polyamide				
Sample 6	575	5.0 mils	Fail	9.5
Sample 6	575	7.5 mils	Marginal	10.0
Sample 6	575	10 mils	Pass	6.0
Sample 6	600	7.5 mils	Marginal	8.0
Polyamide				
Sample 7	575	5.0 mils	Marginal	8.5
Sample 7	575	7.5 mils	Pass	10.5
Sample 7	575	10 mils	Pass	12.0
Sample 7	600	7.5 mils	Pass	12.0
Level loop – Polyamide				
Sample 8	575	5.0 mils	Pass	N/A
Sample 8	575	7.5 mils	Pass	N/A
Sample 8	575	10 mils	Pass	N/A
Sample 8	600	7.5 mils	Pass	N/A
Cut pile – Polyamide				

